
Two New Species with Pendulous Fruits in *Hesperis* (Brassicaceae) from South Anatolia, Turkey

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ABSTRACT. Two new species, *Hesperis anatolica* A. Duran and *H. hamzaoglui* A. Duran (Brassicaceae), are described and illustrated from Anatolia, Turkey. *Hesperis anatolica* grows in serpentine pebbly slopes and open pine forest and scrub in Pozantı and Karsantı (Adana province). It is closely related to *H. persica* Boissier, an endemic confined to South Anatolia. *Hesperis hamzaoglui* grows in granitic rocky sites in a forest-steppe ecotone from Zorkun Yayla (Osmaniye province). It is closely related to *H. podocarpa* Boissier, an endemic confined to the Amanos Mountains. Diagnostic morphological characters are discussed, as well as the ecology, biogeography, and conservation status of both new species. In addition, the pollen characteristics and seed coat surface of *H. anatolica*, *H. persica*, *H. hamzaoglui*, and *H. podocarpa* are examined by SEM. *Hesperis anatolica* is diploid with a new report of the chromosome number of $2n = 12$.

Key words: Brassicaceae, Cruciferae, *Hesperis*, IUCN Red List, Matthioleae, Turkey.

The genus *Hesperis* L. (Brassicaceae) is distributed in the warm climate belt of Eurasia in South and Central Europe, southwest Asia, the Caucasus, Russia, and mountainous regions of western China and Mongolia. This genus has almost 56 species throughout the world (Fournier, 1866; Tzvelev, 1959; Dvořák, 1980; Duran et al., 2002, 2003; Duran & Ocaik, 2005; Al-Shehbaz et al., 2006). Most species in Anatolia are confined to rather restricted areas of distribution. On the other hand, those occurring in moist areas are more widespread, especially in the Euro-Siberian phytogeographic region.

Hesperis is represented by many taxa in Anatolia, which is the junction of the Irano-Turanian, Mediterranean, and Euro-Siberian phytogeographic regions. Toward the outer boundaries of these phytogeographic regions, *Hesperis* is represented by fewer taxa. The number of *Hesperis* taxa in different floras also supports this view. *Hesperis* is represented by 14 species in Europe (Ball, 1964), 11 species in Iran (Dvořák, 1968), nine species in Romania (Săvulescu, 1955), five species in Iraq (Dvořák, 1980), three

species in Italy (Pignatti, 1982), one species in Palestine (Zohary, 1966), and 27 species in Turkey (Duran et al., 2003; Duran & Ocaik, 2005).

Dvořák carried out morphological, cytological, and palynological studies on *Hesperis* species (Dvořák, 1964, 1966a, b, 1973; Dvořák & Dadakova, 1974), described new *Hesperis* taxa, and revised the genus *Hesperis* for both the *Flora of Iraq* and *Flora Iranica* (Dvořák, 1968, 1980).

Characters used in the systematics of the Brassicaceae are evaluated, and some problems relating to various genera and tribes are discussed. The tribe Hesperideae is unigeneric, consisting of the genus *Hesperis*. The tribe is readily distinguished from the rest of the Brassicaceae by having stalked glands with uniseriate stalks terminating in a unicellular gland. Multicellular stalked glands occur in the Chorisporeae and Anchonieae, but in these tribes the stalks are multiseriate and the glands are multicellular (Al-Shehbaz et al., 2006).

The genus *Hesperis* was revised by Cullen (1965) to include 21 species for the *Flora of Turkey*. Seven new species have since been described from Turkey, as well as four newly recorded from Turkey (Davis et al., 1988; Duran & Ocaik, 2005; Parolly & Tan, 2006). In this paper, *H. anatolica* A. Duran and *H. hamzaoglui* A. Duran are described as two new species, bringing the total number of *Hesperis* species for Turkey to 34.

The author collected some interesting *Hesperis* specimens with flowers and fruit on botanical trips to the Amanos Mountains (Osmaniye province) and Toros Mountains (Adana province) in the 1999 and 2003 growing seasons. The specimens were not referable to any known *Hesperis* species. Studying the specific descriptions of *Hesperis* in Ball (1964), Busch (1939), Cullen (1965), Davis et al. (1988), Dvořák (1968, 1980), Halácsy (1900), Hayek (1927), Pignatti (1982), Săvulescu (1955), Tan and Iatrou (2001), Tzvelev (1959), Zohary (1966), and Duran and Ocaik (2005), as well as comparison with specimens in the herbaria AEF, ANK, BM, E, GAZI, HUB, ISTF, K, KNYA, MSB, P, VANF, and WU, showed that the specimens represent two species new to science. The full list of examined representatives of *H. podocarpa*

Boissier, *H. cappadocica* E. Fournier, *H. pendula* DC., and *H. persica* Boissier is available from the author.

MATERIAL AND METHODS

Specimens belonging to both new species were collected both with flower and with fruit from the type locality. Each numeric value is the average of 10 measurements from different specimens.

For palynological studies, pollen samples were taken from the specimens at herbarium KNYA and prepared for light microscopy (Wodehouse, 1935), with descriptive terminology from Faegri and Iversen (1975). Measurements on a Nikon E600 (Nikon Corporation, Tokyo, Japan) microscope were based on 50 samples or more for pollen diameter and ca. 10 samples for other features. For SEM studies, pollen grains were hydrated with 10% KOH for ca. 10 min., then rinsed with distilled water and dried before mounting and sputter coating with gold for SEM micrographs with a JSM-5600 (JEOL Ltd., Tokyo, Japan) microscope. SEM micrographs for seed morphology were similarly taken and the descriptive terminology of Brochmann (1992) followed.

For the study of somatic chromosomes, root tips were obtained from germinated seeds, which were pre-treated in α -monobromonaphthalene overnight and then fixed in alcohol:acetic acid (3:1). Roots were hydrolyzed in 1N HCl at 60°C for 16 min. and Feulgen stained, and squashes were made in 1% lactopropionic orcein. Permanent slides were made in Depex. Chromosome numbers were based on at least five metaphase plates.

SPECIES OF *HESPERIS*

1. *Hesperis anatolica* A. Duran, sp. nov. TYPE: Turkey. Adana: Pozantı, betw. Hamidiye–Karakuz (Çamlıbel), 4 km, serpentine pebbly slopes, open *Pinus* forest, scrub, 1400 m, 37°32.30'N, 34°00.38'E, 16 May 1999, A. Duran 4498 (holotype, KNYA; isotypes, ANK, E, GAZI, HUB). Figure 1.

Affinis *Hesperidi persicae* Boissier sed ab ea caulibus pilis glandulosis (non plerumque simplicibus) pubescentibus, foliis semi-carnosis spathulatis usque lyratis (non oblongis usque oblanceolatis), petalis 13–17.5 mm (non 18–22.5 mm) longis, siliquis pilis glandulosis indutis (non plerumque glabris) atque seminibus 3.4–4 mm (non 2.4–3.4 mm) longis differt.

Biennial herb; roots thickened, 2.5–6(–9) mm diam.; stems ascending, 25–40(–55) cm, generally purplish below and greenish above, sometimes entirely purplish, often solitary or rarely 2, richly branched at base, terete, smooth, 2–7 mm diam.

below, pubescent with densely stalked short glandular and sometimes a few long simple hairs below, 1.7–2.2 mm. Leaves crowded on lower and middle stems, semifleshy, partly purplish especially in lower leaves; basal leaves spatulate to lyrate, 4–10(–16) × 1–2(–3.5) cm (including petiole), remotely denticulate, rarely undulate, irregularly coarsely toothed below, terminal segments \pm circular; petiole 1.5–3(–6) cm, sharply narrower at base, \pm obtuse, all with main midrib conspicuous, purplish, with indumentum of mostly stalked glandular hairs, sparsely simple and bifurcate hairs, and bifurcate hairs especially at margin; cauline leaves acropetally decreasing, indumentum similar to basal leaves, sometimes bifurcate hairs absent; middle cauline leaves spatulate, lyrate, or broadly oblong, petiolate, mostly suddenly narrowed into petiole, sinuate, remotely denticulate to coarsely toothed below, obtuse or \pm acute; upper cauline leaves broadly ovate to oblanceolate, short petiolate or sessile, somewhat cordate, sinuate or irregularly denticulate, obtuse or \pm acute. Inflorescence a raceme, branches ascending, 20–30(–40) × 15–20(–30) cm; pedicels ascending at flowering, deflexed immediately after anthesis, slender, 3–4 mm at anthesis, elongating to 7 mm in fruit, with glandular hairs. Flowers ebracteate; sepals pinkish to violet, somewhat greenish below, oblong, deciduous, with 6 to 9 veins, 6–8 × 2–2.8 mm, with short glandular hairs, long simple hairs on tips, rarely a few bifurcate hairs, with membranous margins, inner sepals strongly saccate. Petals spatulate to obovate, 13–17.5 × 4.3–6 mm, pinkish to violet, veins inconspicuous; limb obovate to orbicular, suddenly narrower into the claw, 5.5–8 × 4.3–6 mm, obtuse, mostly horizontal, and rarely slightly deflexed; claw 7–10 × ca. 1.7 mm, claw clearly exerted from sepal; outer filaments not dilated at base, 2.8–3.1 mm, inner filaments dilated at base, 4.4–5.1 mm, whitish or \pm pinkish; anthers all fertile, \pm linear, 2–2.6 mm, yellowish or greenish, basifixed; stigma with 2 obtuse, decurrent carpoid lobes; ovary often with hairs. Fruiting pedicels slightly thickened, 0.7–1.1 mm diam.; fruits (25–)55–90(–110) × 1.8–3.1 mm, terete, dehiscent, somewhat indehiscent on tips, slightly torulose, straight or slightly curved, pendulous, pubescent stalked glandular and very rarely a few long simple hairs, greenish to yellowish, or partly purplish; valves slightly broader than septum; septum membranous at seed, semimembranous or \pm spongy elsewhere, with invisible median veins; seeds brown, 3.4–4 × 1–1.4 mm, 2 to 14 in number.

Distribution and habitat. *Hesperis anatolica* appears to be endemic to South Anatolia (Adana province in Turkey) and belongs in the East



Figure 1. *Hesperis anatolica* A. Duran. —A. Habit. —B. Fruit. Drawn from the holotype Duran 4498 (KNYA).

Mediterranean floristic element. The specimens were collected in Adana province, where the species appears to be rare and local. *Hesperis anatolica* grows in serpentine pebbly slopes, with open *Pinus* forest and scrub with *P. brutia* Tenore, *P. nigra* Arnold, *Juniperus excelsa* M. Bieberstein, *Aethionema specio-*

sum Boissier & Huet, *Alyssum desertorum* Stapf, *Erysimum thyrsoideum* Boissier, *Papaver tauricola* Boissier, *Silene aegyptiaca* (L.) L. f., *Cicer pinnatifidum* Jaubert & Spach, *Cistus laurifolius* L., *Scandix pecten-veneris* L., *Vincetoxicum tmoleum* Boissier, *Salvia cryptantha* Montbret & Aucher ex Bentham,

Ziziphora capitata L., *Asphodeline lutea* (L.) Reichenbach, *Quercus cerris* L., *Q. pubescens* Willdenow, *Aegilops biuncialis* Visiani, and *Dactylis glomerata* L., from 800 to 1800 m in altitude.

IUCN Red List category. Although the type population is not in good condition, its distribution extends to two localities in Adana province (Pozanti and Karsanti) in Turkey. Its leaves and flowers have been subject to grazing by animals for many years, and therefore in areas of both localities the species is under threat. In my opinion, *Hesperis anatolica* should be considered Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Hesperis anatolica* has been found flowering in May and June, and fruiting in June and July.

Seed and pollen morphology. The seed coat surfaces of *Hesperis anatolica* and *H. persica* are similar in the reticulate-verrucate ornamentation (Fig. 2), but otherwise differ. In *H. anatolica*, the reticulum wall is thin (3.9–4.7 μm), slightly moniliform, with undulations traversing the interspaces, and the muri are pentagonal lengthwise (A. Duran 4959). In *H. persica*, the reticulum wall is thick (8–8.3 μm), with undulations traversing the interspaces, a pentagonal shape to the muri, and with equilateral sides (A. Duran 4707).

Pollen of *Hesperis anatolica* and *H. persica* are similar in both shape and size, and are generally stable (Table 1, Fig. 3). Although the aperture type of *H. anatolica* is generally syncolpate, it is tricolpate in *H. persica*.

Discussion. *Hesperis anatolica* is related to *H. persica*, but differs mainly in its stems with mostly glandular hairs (vs. mostly simple hairs); the semifleshy leaves with mostly stalked glandular, sparsely simple and bifurcate hairs (vs. not semifleshy, with long simple and short glandular hairs); the spatulate to obovate petals, 13–17.5 \times 4.3–6 mm (vs. oblanceolate, 18–22.5 \times 3.5–4.5 mm); the fruits with stalked glandular hairs (vs. glabrate); and the seeds 3.4–4 mm long (vs. 2.4–3.4 mm). Diagnostic characters comparing *H. anatolica* and *H. persica* are provided in Table 2.

Another similar species, *Hesperis borbasii* Dvořák, grows naturally and is endemic to Iran. *Hesperis borbasii* is quite similar to *H. persica*, but principally differs in its entirely glabrous form.

Hesperis podocarpa is readily distinguished from *H. anatolica* by its stems mostly tufted, with dense, long simple hairs. The basal leaves are oblong or oblanceolate, entire, sinuate, and slightly lyrate-pinnatifid, with mostly long simple, short glandular

hairs; the pedicels are ascending to erect at anthesis, \pm graceful, slender, 2.5–10 mm long at anthesis, to 13 mm; the sepals are 7–10 mm long; the petals are 19–25 mm long, and deep violet or mauve in color; the ovary is glabrous; and the fruits are 1.2–2 mm wide, indehiscent, glabrous at maturity, with the septum membranous at seed attachment, and more abundantly developing spongy matter between the seeds. *Hesperis podocarpa* is distributed only in Gaziantep and Hatay provinces and is endemic to Turkey; it is related to *H. persica* (Duran et al., 2003).

The semifleshy leaves of *Hesperis anatolica* are noted for the first time in the genus, and this leaf character is a reliable diagnostic feature (Busch, 1939; Ball, 1964; Cullen, 1965; Dvořák, 1968; Davis et al., 1988; Duran et al., 2003).

Paratypes. TURKEY. **Adana:** Pozanti, betw. Hamidiye–Karakuz (Çamlıbel), 4 km, 1400 m, 37°32.30'N, 34°00.38'E, 24 July 1999, A. Duran 4959 & Hamzaoğlu (KNYA, MO), 20 June 2000, A. Duran 5335 & Sağıroğlu (KNYA), 2 July 2001, A. Duran 5722 & Sağıroğlu (KNYA); Pozanti, betw. Hamidiye–Karakuz (Çamlıbel), 880 m, 16 May 1999, 37°30.91'N, 35°01.85'E, A. Duran 4500 & Adıgüzel (KNYA); E of Pozanti, 1000–1100 m, 3 May 1990, H. Duman 4524 (GAZI); Karsanti, Pos ormanı, Şamadan bölgesi, Deveçökeği mevki, ca. 1230 m, 1 June 1973, E. Yurdakulol 1323 (ANK); Karsanti, Soğukoluk KB sırtı, Faraşa yolu, ca. 1420 m, 14 June 1972, E. Yurdakulol 17 (ANK); Karsanti, Hızar bölgesi, Hızar gediği, ca. 1800 m, 1 June 1973, E. Yurdakulol 1326 (ANK).

2. *Hesperis hamzaoglu* A. Duran, sp. nov. TYPE: Turkey. Osmaniye: Amanos Mtn., Zorkun, Keldazı hill, 1750 m, 36°58.95'N, 36°24.22'E, 20 May 2001, A. Duran 5694 & Hamzaoğlu (holotype, KNYA; isotypes, ANK, E, GAZI, HUB). Figure 4.

Affinis *Hesperidi podocarpae* Boissier, sed ab ea plantis 13–28 cm (non 20–70 cm) altis, caulibus pilis glandulosis (non hispidis) dense pubescentibus, foliis basalibus anguste spatulatis et irregulariter denticulatis (non lyratis, pinnatilibus usque pinnatisectis et infra grosse dentatis), petalis 17–21 cm (non 19–25 cm) longis, siliquis pubescentibus (non glabris) differt.

Perennial herb; roots thickened, 3–8(–12) mm diam.; stem \pm erect, 13–20(–28) cm, sometimes purplish below, solitary or rarely 2 to 6, mostly branched with flowering part \pm terete, smooth, 2–5 mm diam. below, pubescent with densely stalked glandular hairs, 0.2–0.3 mm, rarely a few long simple hairs 1.6–2 mm above. Leaves crowded especially on lower stems, these \pm swollen, closely overlapping; basal leaves narrowly spatulate to oblanceolate, 3–6 (–10) \times 0.5–1.2(–2) cm (including petiole), irregularly dentate to denticulate, petiole 1–2 cm, lamina of radical leaves attenuate into basal petiole, obtuse or \pm acute, all with main midrib \pm conspicuous, with

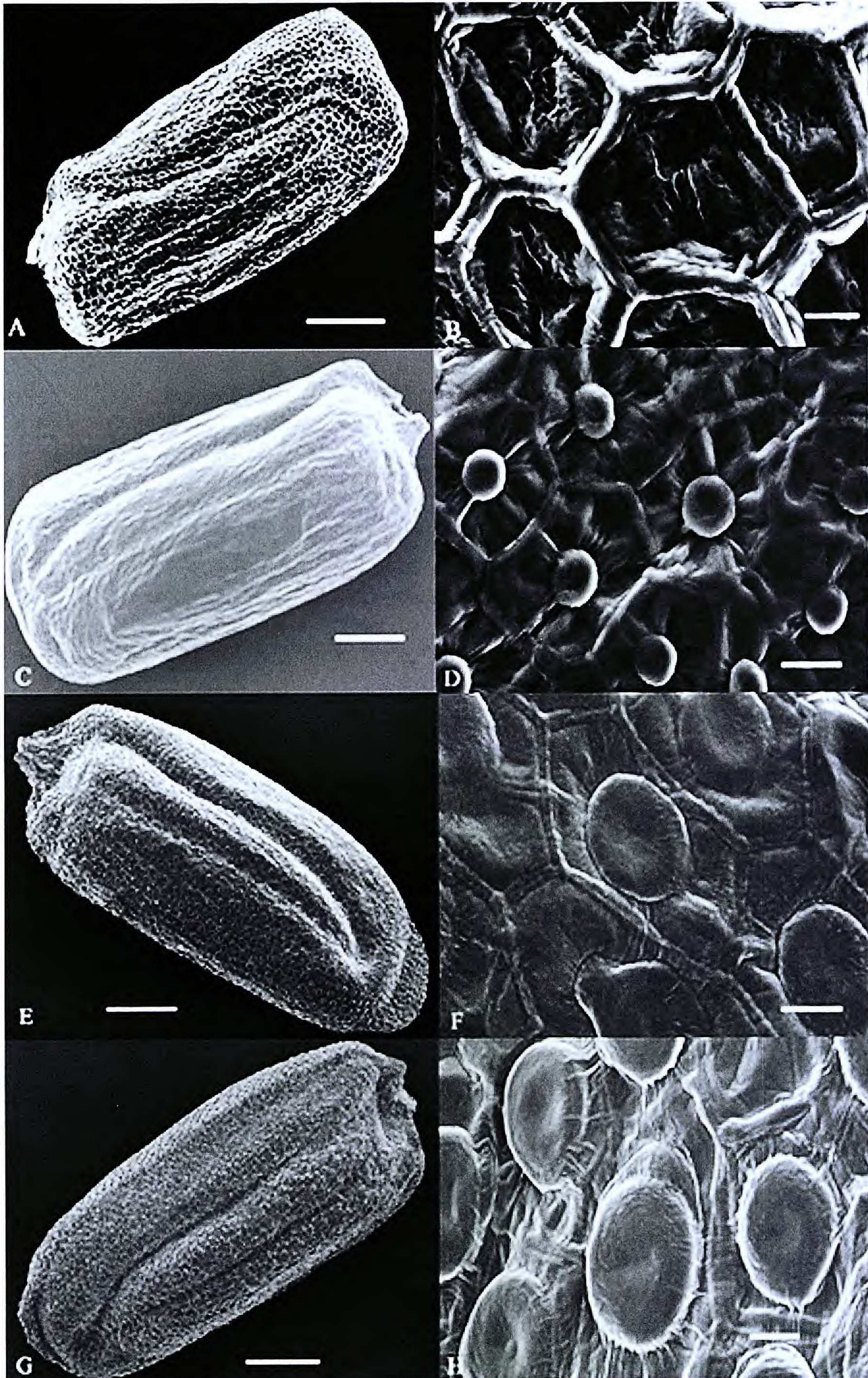


Figure 2. SEM images of seed coat surfaces. —A, B. *Hesperis hamzaoghui* (A. Duran 5758, KNYA). —C, D. *H. podocarpa* (A. Duran 5317, KNYA). —E, F. *H. anatolica* (A. Duran 4959, KNYA). —G, H. *H. persica* (A. Duran 4707, KNYA). Scale bars: A, C, E, G = 500 μ m, B, D, F, H = 20 μ m.

indumentum of mostly stalked glandular hairs or a few long simple hairs, rarely a few bifurcate hairs; cauline leaves of similar size at midstem, or acropetally decreasing, indumentum similar to basal leaves,

narrowly oblong to oblanceolate, short petiolate or sessile, attenuate into petiole, remotely \pm denticulate or entire, obtuse or subacute; upper cauline leaves narrowly oblong, oblanceolate, or lanceolate,

Table 1. Pollen morphology of *Hesperis anatolica*, *H. hamzaoglu*, *H. persica*, and *H. podocarpa*.

Species	Polar axis (μm)	Equatorial axis (μm)	Pollen shape	Ornamentation					
				Intine thickness (mean) (μm)	Exine thickness (mean) (μm)	Shape	Muri width (mean) (μm)	Lumina width (mean) (μm)	Aperture type
<i>H. anatolica</i>	23.0–25.2	21.2–22.9	subprolate	0.3	2.0	reticulate	0.75	1.75	syncolpate
<i>H. hamzaoglu</i>	15.3–16.7	11.6–12.8	subprolate	0.5	1.7	reticulate	0.25	1	syncolpate
<i>H. persica</i>	20.6–21.4	20.0–20.8	prolate-spheroidal	0.5	1.6	reticulate	0.75	1.25	tricolpate
<i>H. podocarpa</i>	17.4–18.5	17.1–18.3	prolate-spheroidal	0.3	1.3	reticulate	0.35	1.25	tricolpate

sessile, subentire or minutely denticulate, \pm acute to acuminate. Inflorescence a raceme, branches \pm erect, 6–13(–18) \times 3–10 cm; pedicels ascending, slender, 4–15 mm at anthesis, elongating to 22 mm in fruit, with mostly stalked glandular, a few simple, or rarely bifurcate hairs. Flowers ebracteate; sepals pinkish to violet, somewhat green below, oblong, deciduous, with 7 to 8 veins, 6.5–10.5 \times 2–2.7 mm, bifurcate, simple and glandular hairs, with membranous margins, inner sepals strongly saccate; petals obovate to lanceolate, 17–21 \times 4–6.5 mm, deep violet, veins conspicuously darker violet; limb oblong to obovate, tapering gradually into the claw, 8–10 mm, \pm obtuse, \pm horizontal or slightly deflexed; claw 8–11 \times 1.6–2 mm, claw clearly exerted above sepal; outer filaments not dilated at base, 3–4 mm, inner filaments dilated at base, 5.8–6.6 mm, \pm purplish above; anthers all fertile, \pm linear, 2.6–3.9 mm, yellowish, basifixed; stigma with 2 obtuse, decurrent carpinal lobes; ovary often with hairs; fruiting pedicels slightly thickened, 0.5–0.8 mm diam.; fruits (25–)40–70(–90) \times 1.4–2 mm, terete, \pm indehiscent, \pm torulose, slightly curved or straight, pendulous at maturity, completely or at least in lower part pubescent with \pm short glandular and sometimes simple and bifurcate hairs, greenish to yellowish, partly or completely purplish green; valves broader than septum; septum membranous only at seed, abundantly developing spongy matter elsewhere, with visible median veins; seeds light brown, 2.7–3.4 \times 1–1.2 mm, 2 to 12 in number.

Distribution and habitat. *Hesperis hamzaoglu* appears to be endemic to the area Zorkun Yayla (Osmaniye, Turkey), South Anatolia, and belongs in the East Mediterranean floristic element. The new species grows in granitic rocky sites within the forest-steppe ecotone with *Cedrus libani* A. Richard, *Berberis crataegina* DC., *Fagus orientalis* Lipsky, *Alyssum oxycarpum* Boissier & Balansa, *Thurya capitata* Boissier & Balansa, *Silene spergulifolia* (Willdenow) M. Bieberstein, *Genista albida* Willdenow, *Cytisopsis dorycniifolia* Jaubert & Spach, *Ferula elaeochytris* Korovin, *Salvia tomentosa* Miller, *S. cryptantha*, *Silene*

doganii A. Duran & Menemen, *Scorzonera yildirimlii* A. Duran & Hamzaoglu, and *Rhabdosciadium oligocarpum* (Post ex Boissier) Hedge & J. M. Lamond, from 1700 to 1800 m altitude (Duran & Menemen, 2003; Duran & Hamzaoglu, 2004).

IUCN Red List category. The specimens were collected in Osmaniye province in Turkey, where the species seems to be very rare and local, from an area of ca. 2.5 acres. The population is not in good condition, with approximately 120 specimens. Therefore, it should be considered Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Hesperis hamzaoglu* has been found flowering in May and June, and fruiting in June and July.

Etymology. The new species is named in honor of the Turkish botanist and professor Ergin Hamzaoglu (Biology Department, Bozok University, Yozgat).

Seed and pollen morphology. The seed coats of *Hesperis hamzaoglu* and *H. podocarpa* were studied by SEM and differ in surface detail. The seed surface ornamentation in *H. hamzaoglu* is reticulate-verrucate (Fig. 2); the reticulum wall is thick (9.1–9.7 μm), with undulations traversing the interspaces, and it is polygonal in shape. In the lumen the wart is absent (A. Duran 5758). The seed surface ornamentation in *H. podocarpa* is reticulate-verrucate (Fig. 2); the reticulum wall is thin (4–4.7 μm), with traverse undulations and polygonal in shape (A. Duran 5317). *Hesperis hamzaoglu* has a thicker reticulum wall than *H. podocarpa*, but lacks the central wart situated in the lumen of *H. podocarpa* (Fig. 2).

SEM analysis showed that *Hesperis hamzaoglu* and *H. podocarpa* are dissimilar in their pollen characteristics (Table 1, Fig. 3). Although the aperture type of *H. hamzaoglu* is generally syncolpate, it is tricolpate in *H. podocarpa*.

Discussion. *Hesperis hamzaoglu* is closely related to *H. podocarpa* (cf. Table 2), but differs in the stems with densely glandular hairs (vs. hispid, mostly mixed

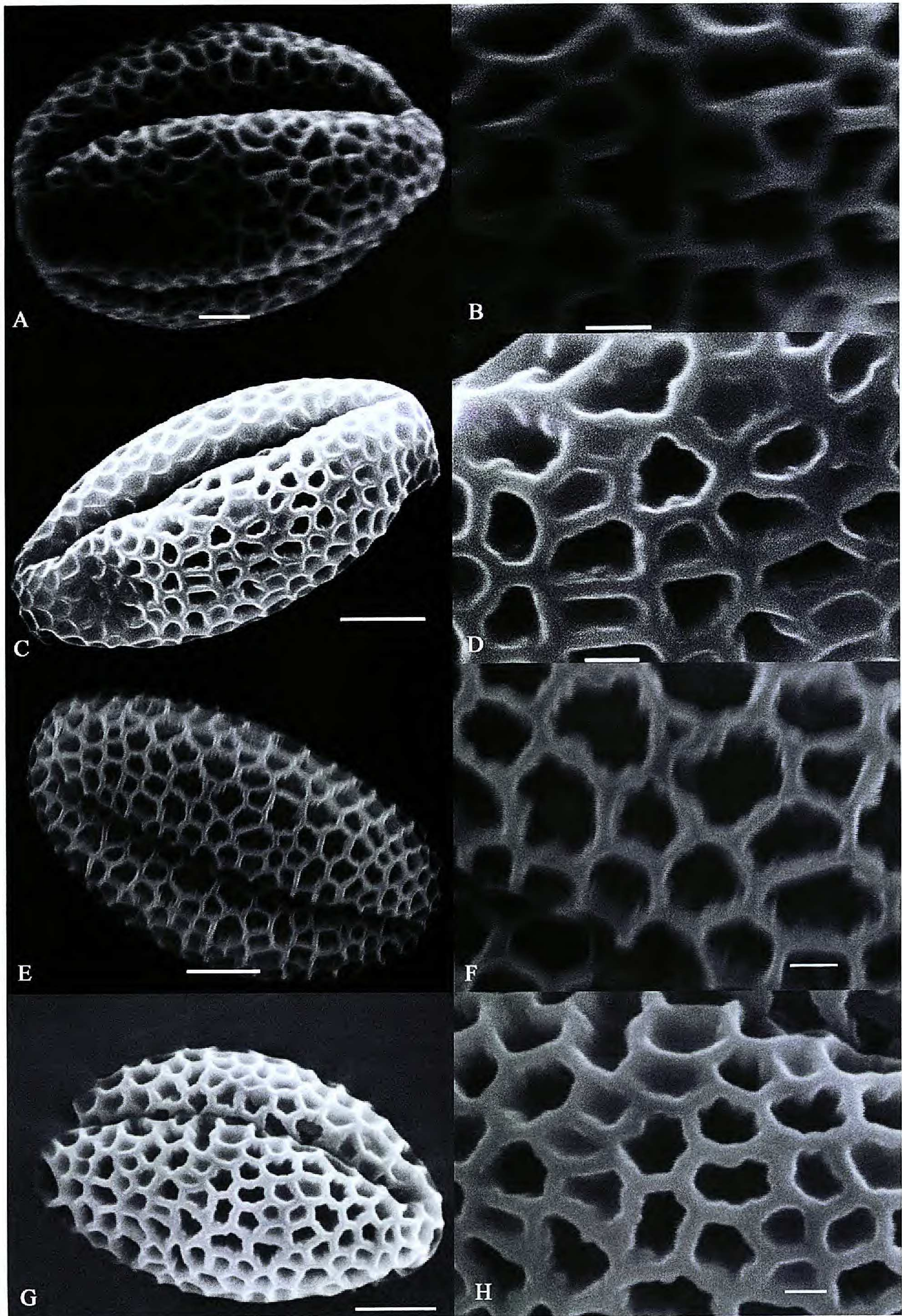


Figure 3. SEM images of pollen grains. —A, B. *Hesperis hamzaoglui* (A. Duran 5694 & Hamzaoglu, KNYA). —C, D. *H. podocarpa* (A. Duran 5031, KNYA). —E, F. *H. anatolica* (A. Duran 4498, KNYA). —G, H. *H. persica* (A. Duran 5198, KNYA). Scale bars: A = 2 μm , C, E, G = 5 μm , B, D, F, H = 1 μm .

hairs); the leaves mostly glandular-pubescent (vs. long simple, short glandular, and sometimes bifurcate hairs); the basal leaves narrowly spatulate to oblanceolate, 3–6 cm long, and entire or irregularly dentate

(vs. oblong, oblanceolate, lyrate, pinnatilobed to pinnatisect); the pedicels with mostly stalked glandular hairs (vs. glabrous or mixed hairs); and the pubescent fruits (vs. glabrous). *Hesperis podocarpa*

Table 2. Diagnostic characters of the new species *Hesperis hamzaoglui* and *H. anatolica* with the related *H. persica* and *H. podocarpa*. Character states are taken from Cullen (1965), Dvořák (1968), and Davis et al. (1988).

Diagnostic characters	<i>H. podocarpa</i>	<i>H. hamzaoglui</i>	<i>H. anatolica</i>	<i>H. persica</i>
Life form	perennial	perennial	biennial	biennial or perennial
Stems	20–70 cm tall, mostly tufted, ± erect	13–20 cm tall, mostly solitary, ± erect	25–55 cm tall, mostly solitary, ascending	30–85 cm tall, mostly tufted, ascending to erect
Stem pubescence	generally hispid, with densely simple and sparsely glandular hairs or only simple hairs	not hispid, with entirely densely stalked glandular hairs	not hispid, but densely stalked glandular and sometimes a few long simple hairs below	sometimes slightly hispid, mostly long simple hairs
Leaves	not semifleshy, with long simple, short glandular, and sometimes bifurcate hairs	not semifleshy, with mostly stalked glandular hairs	semifleshy, with mostly stalked glandular, sparsely simple, and bifurcate hairs	not semifleshy, with long simple and short glandular, rarely a few bifurcate hairs
Basal leaves	5–10 × 0.5–2 cm, oblong, oblanceolate, lyrate, pinnatilobed to pinnatisect, irregularly coarsely toothed below	3–6 × 0.5–1.2 cm, narrowly spatulate to oblanceolate, entire or irregularly dentate to denticulate	4–10 × 1–2 cm, spatulate to lyrate, terminal segments ± circular	10–18 × 1–2.5 cm, oblong to oblanceolate
Petiole length	2–6 cm	1–2 cm	1.5–3 cm	4–8 cm
Pedicel	± graceful, 2.5–10 mm at anthesis, elongating to 13 mm and finally deflexed, glabrous, bifurcate, or glandular and simple hairs	4–15 mm at anthesis, elongating to 22 mm in fruit and finally deflexed, with mostly stalked glandular hairs	3–4 mm at anthesis, elongating to 7 mm in fruit and deflexed immediately after anthesis, with glandular hairs	2–5 mm at anthesis, elongating to 9 mm and finally deflexed, mixed hairs or ± glabrous
Sepals	pinkish to violet, somewhat partly greenish, 7–10 mm	pinkish to violet, greenish below, 6.5–10.5 mm	pinkish to violet, 6–8 mm	partly purplish, 7–10 mm
Petals	19–25 mm, obovate to lanceolate, deep violet or mauve	17–21 mm, obovate to lanceolate, deep violet	13–17.5 mm, spatulate to obovate, pinkish to violet	18–22.5 mm, oblanceolate, purple-brown, reddish or yellow, violet, deep purple, or chocolate brown
Limb	obovate to oblanceolate, tapering gradually into the claw	oblong to obovate, tapering gradually into the claw	obovate to orbicular, suddenly narrower into the claw	obovate, tapering gradually into the claw
Ovary	glabrous	often with pubescence	pubescent	mostly glabrous, rarely asperulous
Fruits	1.2–2 mm wide, terete, glabrous, with median veins not visible	1.4–2 mm wide, terete, indehiscent, completely or at least lower part pubescent, with visible median veins	1.8–3.1 mm wide, terete, dehiscent, somewhat indehiscent on tips, pubescent, with median veins not evident	2–2.8 mm wide, slightly flattened to terete, dehiscent, glabrous or with short simple hairs, with ± visible median veins
Seed length	3–4.2 mm	2.7–3.4 mm	3.4–4 mm	2.4–3.4 mm
Reticulum wall of seed coat	thin (4–4.7 μm)	thick (9.1–9.7 μm)	thin (3.9–4.7 μm)	thick (8–8.3 μm)
Pollen shape	prolate-spheroidal	subprolate	subprolate	prolate-spheroidal
Aperture type	tricolpate	syncolpate	generally syncolpate	tricolpate



Figure 4. *Hesperis hamzaoglui* A. Duran. —A. Habit. —B. Fruits. Drawn from the holotype Duran 5694 & Hamzaoglu (KNYA).

grows naturally in Turkey and is a local endemic, with an allopatric distribution in relation to *H. hamzaoglui*. Diagnostic characters comparing *H. hamzaoglui* and *H. podocarpa* are provided in Table 2.

Hesperis persica is distinguished from *H. hamzaoglui* by characteristics listed in Table 2. The former species is distributed in Turkey, Iran, Iraq, and Azerbaijan, and is morphologically related to *H. hamzaoglui*.

Paratypes. TURKEY. **Osmaniye:** Amanos Dağları, Zorkun yaylası, Keldazi tepesi, 1750 m, 36°58.95'N, 36°24.22'E, 17 June 2000, A. Duran 5285 & Hamzaoglu (KNYA, MO), 5 July 2001, A. Duran 5758 (KNYA), 5 July 2003, A. Duran 6280 & Sağiroğlu (KNYA).

Taxonomy. Only five species of the genus *Hesperis* have pendulous fruits: *H. persica*, *H. borbasii*, *H. podocarpa*, *H. pendula*, and *H. cappadocica* (Busch, 1939; Ball, 1964; Cullen, 1965; Dvořák, 1968; Davis et al., 1988; Duran et al., 2003). *Hesperis cappadocica* from section *Contorta* (Dvořák) A. Duran has fruits 3–7 mm wide that are dorsally flattened, dehiscent, with toothed margins, and contorted. In *H. pendula*, the stem has long or short simple and short glandular hairs; the leaves have mostly long simple, or short glandular and bifurcate hairs; the pedicels are 1.5–2.5 mm at anthesis, elongating to 4 mm, and densely pubescent; the petals are oblong-obovate, 16.5–22(–25) × 3–5(–8) mm, yellowish, varying in part from light purple to brownish purple, purplish or violet, or violet to pinkish; the ovary is densely pubescent; and the fruits are 25–70 × 2.2–3.5 mm, ± dehiscent, and densely pubescent (Ball, 1964; Cullen, 1965; Dvořák, 1968, 1980; Davis et al., 1988; Duran et al., 2003).

Fournier (1866) transferred the species in section *Deilosma* Andrásovszky into the newly described species in section *Pachycarpus* E. Fournier on the basis of their fruit characteristics. Section *Pachycarpus* is mainly characterized by its indehiscent fruits. Tzvelev (1959) extended the description of the section *Pachycarpus* by including the characteristics of somewhat dehiscent fruits into the section. Fournier (1866) and Tzvelev (1959) categorized the infrageneric classification of *Hesperis* species into three sections: *Hesperidium* DC., *Deilosma*, and *Pachycarpus*. The new species *H. hamzaoglui* and *H. anatolica* are both included in section *Pachycarpus*.

Cytology. Chromosome numbers of *Hesperis* taxa are reported as $n = 6, 7, 8, 12, 14, 16, 20, 24$, and $2n = 12, 14, 16, 24, 28$ (Dvořák & Dadáková, 1974; Khosravi & Maassoumi, 1998; Warwick & Al-Shehbaz, 2006). Chromosome counts for *H. anatolica* reveal a diploid count of $2n = 12$, a new report, which corresponds to the base number for section *Pachycarpus*. Chromosome numbers in related species in section *Pachycarpus* are $2n = 12$ in *H. pendula* and *H. persica*, which also have pendulous fruits. A chromosome count for *H. hamzaoglui* was not possible due to the mucilage layer that covered the seeds, which negatively affected seed germination (Martin, 2003).

Biogeography. The Cilician Taurus mountain range occupies the intersection of the Mediterranean and Irano-Turanian phytogeographic regions, lying

also on the Anatolian Diagonal. The Amanos mountain range is also biogeographically significant, occupying an intersection of the Mediterranean phytogeographic region and the Anatolian Diagonal, with many Euro-Siberian phytogeographic region enclaves (Atalay, 1994). This transition zone north and south of the Amanos Mountains is a restricted area where the Euro-Siberian floristic elements spread to the west. The Euro-Siberian flora is very poor in endemic taxa, most of the elements being widely distributed species, and is strongly influenced by Mediterranean elements. Therefore, the enclave flora of the Amanos Mountains is fairly rich and relictual, with local, regional, and paleoendemic taxa. These taxa include *Galatella amani* (Post) Grierson, *Prangos turcica* A. Duran, M. Sağiroğlu & H. Duman, *Silene doganii*, *Scorzonera yildirimlii*, *Draba haradjianii* Rechinger f., and *Cephalaria amana* Rechinger f. (Duran & Menemen, 2003; Duran & Hamzaoglu, 2004; Duran & Ocak, 2005; Duran et al., 2005). Of 13 *Hesperis* species (including the two new taxa) found in the Anatolian Diagonal, nine are endemic in Turkey (Cullen, 1965; Davis et al., 1988; Duran et al., 2003; Duran & Ocak, 2005). The concept of the Anatolian Diagonal was proposed by P. H. Davis (1971), who defined it as an oblique belt running from the northeast, south to the Anti-Taurus Mountains where it then divides, with one branch to the Amanos Mountains (Amanos Dağları) and the other to the Cilician Taurus Mountains. Thirty-three percent of the total species growing in Turkey are found along this diagonal, with 5% more or less restricted to it. One explanation for this present species richness is neo-endemism, with plant distribution patterns related to the Diagonal (Ekim & Güner, 1986).

KEY TO *HESPERIS* SPECIES WITH PENDULOUS FRUITS IN TURKEY

- 1a. Fruit contorted, flattened *H. cappadocica*
- 1b. Fruits not contorted, ± terete.
 - 2a. Fruits glabrous (rarely only sparse short simple hairs).
 - 3a. Petals purple, greenish to brownish purple, the limb strongly deflexed; fruits dehiscent *H. persica*
 - 3b. Petals deep violet or mauve, the limb not deflexed; fruits indehiscent . . . *H. podocarpa*
 - 2b. Fruits glandular, with long simple or mixed hairs.
 - 4a. Stem patently hispid, with simple, glandular, and rarely bifurcate hairs . . *H. pendula*
 - 4b. Stem not hispid, with mostly glandular hairs.
 - 5a. Biennial; basal leaves broadly spatulate to lyrate, semifleshy; petals 13–17.5 mm long; fruits dehiscent. *H. anatolica*
 - 5b. Perennial; basal leaves narrowly lyrate, not fleshy; petals 17–21 mm long; fruits indehiscent. *H. hamzaoglui*

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